

**OSU Testing Center**

101 UAT Building, (405) 744-5958  
 testing.center@okstate.edu  
 http://testing.okstate.edu/

**OSU Testing Center Use Only:**

Test Date: <u>7/14</u>	Initial: <u>AD</u>	Station #
Time Started: <u>3:15</u>	Initial: <u>AD</u>	
Time Finished: <u>4:20</u>	Initial: <u>AD</u>	

**INSTRUCTOR:** In order to have your test proctored to your specifications, please complete **ALL** the following fields after visiting with your student and submit this form with your test. Forms and tests should be dropped off in 100 UAT Building or emailed to testing.center@okstate.edu **at least 24 hours in advance** of the student's appointment. The OSU Testing Center provides accommodated testing for students with disabilities. Student Disability Services (SDS) notifies instructors regarding testing accommodations for students in their courses. If you have questions or concerns about student accommodations, please contact the SDS office at 405-744-7116.

**PLEASE NOTE:** Submission of this form does **NOT** create an appointment for the student. Students **MUST** schedule their own appointments (at least 24 hours in advance, recommended 1 week in advance) to take a test at the OSU Testing Center.

**STUDENT(S), INSTRUCTOR, & TEST DETAILS**

Exam Type: ☐ Student Disability Services (SDS) Exam ☐ OSU Course Exam (non-SDS) ☒ Other Institution Exam

Student Name(s): See attached email for list of names

Instructor Name: Terry Collins

Other Institution Name: OSU

Instructor Phone: 405-744-6055

Course Name: Engineering Economic Analysis

Instructor Email: terry.collins@okstate.edu

Course Prefix/Number: IEM 3503/3513

Department Phone: x45148

Test/Exam Title: Test 5

Is the Test ☒ Paper-Based or ☐ Online?

Test Date (as arranged with student): 7/13/17 8:00 a.m.

Is Test Date flexible? ☒ Yes ☐ No

Test Time (as arranged with student): 7/17/17 5:00 p.m.

Is Test Time flexible? ☒ Yes ☐ No

Class Time allowed for test: \_\_\_\_\_ Hour(s) and 75 Minutes

*The OSU Testing Center will calculate accommodation time for SDS students based on instructions provided by Student Disability Services.*

**TEST ADMINISTRATION INSTRUCTIONS****Testing materials required/allowed by the instructor:**

- |   |   |  |  |
|---|---|--|--|
| <input checked="" type="checkbox"/> Notes       | <input type="checkbox"/> Orange Scantron              | <input type="checkbox"/> Graphing Calculator     | <input type="checkbox"/> English Dictionary  |
| <input checked="" type="checkbox"/> Textbook(s) | <input type="checkbox"/> Green Scantron               | <input type="checkbox"/> Non-graphing Calculator | <input type="checkbox"/> Language Dictionary |
| <input type="checkbox"/> Scratch Paper          | <input checked="" type="checkbox"/> Mechanical Pencil | <input type="checkbox"/> Computer Use            | <input type="checkbox"/> LockDown Browser    |
| <input type="checkbox"/> Blue Book              | <input type="checkbox"/> Highlighters                 | <input type="checkbox"/> Ruler/Straight Edge     | <input type="checkbox"/> Colored Pencils     |

**Additional Instructions, Directions, Requirements, Passcodes, or Other Information:**

Open book, one page of notes 8 1/2 X 11, attach notes to test when submitted for grade.  
 No cell phones or back packs in testing area. See test for complete instructions.

**Please Note:** If special software is required, software and detailed installation instructions must be submitted to the OSU Testing Center at least a week in advance, and the OSU Testing Center reserves the right to not test a student if the software cannot be installed, operated, and removed easily.

**TEST RETURN INSTRUCTIONS**

How do you want the completed test materials returned to you? Please check ONE.

\_\_\_\_\_ Please hold. I will pick up test (must show photo ID).

\_\_\_\_\_ I have authorized \_\_\_\_\_ to pick up the test (must show photo ID).

☒ **Deliver** test within 72 hours to 101 EN (Bldg/Rm) OR departmental office \_\_\_\_\_ (Bldg/Rm).

**NOTE:** If the OSU Testing Center is unsuccessful in delivering a test to an instructor's office and no departmental office is provided, the test will be held at 100 UAT Building for pick-up by the instructor.

**Tests not administered will be retained for two weeks after the end of the semester and then destroyed.**

Received by Signature: \_\_\_\_\_

Print Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Statement of Academic Honesty

The following form is standard procedure for an exam that may be offered multiple times. Read the material below, then complete the form and return it with your completed exam. Your exam will not be graded unless a completed copy of this form is on file.

Course: IEM 3503/3513 Summer 2017

Test: Weekly Test # 5

There are others who may be taking this exam or a similar exam at a later date. You are in no way to have any form of direct or indirect communications regarding this exam with anyone. If someone asks something as simple as "How was it?" your best response is "I cannot talk about the exam." Any violation of the letter or spirit of the above will be treated as an act of academic dishonesty.

By completing the information below, I acknowledge that I have read and understood the Statement of Academic Honesty above.

Name (signature)

(b)(6)

Name (print):

(b)(6)

Student ID:

(b)(6)

Today's Date:

7/14/16

NAME:

(b)(6)

DR. A. COLLINS

TEST #5 (ON-LINE SECTION ONLY)

TIME LIMIT: 75 MINUTES

TEST TIME WINDOW: THURSDAY, JULY 13, 2017 (8:00AM) TO MONDAY  
JULY 17, 2017 (5:00PM)

(OPEN BOOK, ONE PAGE OF NOTES – 8 ½ X 11)

Attach Notes Page to back of Test when submitted for gradeABSOLUTELY NO CELL PHONES OR BACKPACKS IN TESTING AREA!!!

Multiple Choice Questions: For each Multiple Choice question below select the most nearest answer from choices A – D. Properly write your selected answer in the blank beside the corresponding question. Each M/C question is worth 10 points each.

- (10) D 1. You decide to open an individual retirement account (IRA) at your local bank that pays 8%/year/year. At the end of each of the next 40 years, you will deposit \$500 per year into the account (40 total deposits). Three years after the last deposit, you will begin making quarterly withdrawals. If you want the account to last 30 years (120 withdrawals), what amount will you be able to withdraw each year (based on the sum of the quarterly payments each year)?
- A. \$43,325/yr  
B. \$33,325/yr  
C. \$23,325/yr  
D. \$13,325/yr
- $$A = 500 (F/A, 8\%, 40) (F/P, 8\%, 2) (A/P, 8\%, 30)$$
- $$= 500 (259.0565) (1.16640) (0.08883)$$
- $$= 13420.6$$
- (10) A 2. A TES (Thermal Energy Storage) system is installed that will cost \$189,000 and is projected to save \$48,115 annually for the life of the project of 18 years. What is the exact Internal Rate of Return (IRR)?
- A. 25%  
B. 35%  
C. 45%  
D. 55%

**Modified Internal Rate of Return:** Transform the following cash flow with multiple sign changes to "ONE" sign change and then calculate the "EXACT" Internal Rate of Return. MARR is 10%.

YEAR	CASH FLOW, (\$)	ADJ. C.F.
0	-16,000	-16000
1	-8,000	-8000
2	11,000	11000
3	13,000	$13000 - 7000(P/F, 10\%, 1)$
4	-7,000	0
5	8,950	8950

Using the information above to answer questions 3 – 4 below:

- (10) C 3. The exact Internal Rate of Return for the cash flow listed above is?
- A. 14.5%
  - B. 6.0%
  - C. 3.5%
  - D. -4.0%
- (10) B 4. Based on the decision threshold of  $IRR \geq MARR$ , is this project desirable?
- A. Yes
  - B. No
  - C. Indifferent
  - D. Not enough information to make a decision
- (10) D 5. The Oklahoma Department of Transportation (ODOT) is looking at the purchase of a new technology highway paving machine for asphalt. The new machine costs \$1,000,000 and is expected to provide a net revenue of \$150,000 per year for 6 years. If MARR is 10%/yr, what is the exact IRR for this project?
- A. 5.30%
  - B. 1.25%
  - C. 0.0%
  - D. -3.0%

The following costs are associated with three new machines being considered for use:

$0 < M1 < M3 < M2$

DATA	MACHINE 1 (M1)	MACHINE 2 (M2)	MACHINE 3 (M3)
Total Cost	\$1,500,000	\$1,980,000	\$1,750,000
Salvage Value	\$145,000	\$205,000	\$178,000
Annual Benefit	\$325,000	\$689,000	\$505,000
M & O	\$102,000 <sup>223,000</sup>	\$163,000 <sup>24,000</sup>	\$104,000 <sup>160,000</sup>
Loan Payment (Annual Expense)	\$196,816	\$259,797	\$229,619
Down Payment	\$450,000	\$594,000	\$525,000
Useful Life	8	8	8

The loan payments are considered an annual expense and are calculated using a current competitive interest rate, a life equal to the life of the machine, and a down payment of 30%. The Company interest rate (MARR) is 12%. Do Nothing "IS" an option. USE INCREMENTAL INTERNAL RATE OF RETURN (IRR) ANALYSIS TO DECIDE WHICH MACHINE SHOULD BE PURCHASED. USE THE PW ANALYSIS METHOD WITH MARR AS YOUR DECISION POINT FOR EACH COMPARISON. DO NOT CALCULATE THE EXACT INTERNAL RATE OF RETURN FOR EACH COMPARISON!!!

Using the information above answer questions 6-10 below:

- (10) C 6. What is the Incremental Analysis ranking for the machines listed above?
- $M1 < M2 < M3 < 0$
  - $0 < M1 < M2 < M3$
  - C  $0 < M1 < M3 < M2$
  - $0 < M2 < M3 < M1$
- (10) B 7. For the IRR Incremental Analysis comparison of Machine 1 – Do Nothing (M1-0) the IRR is:
- Greater than MARR, so keep Machine 1 and drop "Do Nothing"
  - Less than MARR, so keep "Do Nothing" and drop Machine 1
  - Greater than MARR, so keep "Do Nothing" and drop Machine 1
  - Less than MARR, so keep Machine 1 and drop "Do Nothing"
- (10) A 8. For the IRR Incremental Analysis comparison of Machine 3 - Do Nothing (M3-0) the IRR is:
- Greater than MARR, so keep Machine 3 and drop "Do Nothing"
  - Less than MARR, so keep "Do Nothing" and drop Machine 3
  - Greater than MARR, so keep "Do Nothing" and drop Machine 3
  - Less than MARR, so keep Machine 3 and drop "Do Nothing"

- (10) C 9. For the IRR Incremental Analysis comparison of Machine 2 – Machine 3 (M2-M3) the IRR is:
- A. Less than MARR, so keep Machine 2 and drop Machine 3
  - B. Less than MARR, so keep Machine 3 and drop Machine 2
  - C. Greater than MARR, so keep Machine 3 and drop Machine 2
  - D. Greater than MARR, so keep Machine 2 and drop Machine 3
- (10) D 10. Based on the IRR Incremental Analysis method, which Machine should be selected?
- A. Do Nothing
  - B. Select Machine 1
  - C. Select Machine 2
  - D. Select Machine 3

$$(PIA, 12, 8) = \left[ \frac{(1 + .12)^8 - 1}{.12(1 + .12)^8} \right] \approx 4.96764$$

$$(PIF, 12, 8) = (1.12)^{-8} \approx 0.40388$$

reset m1

to

(SCRATCH PAGE, LEFT BLANK INTENTIONALLY)

$$NPW(12\%)_{M1-0} = -1500000 + [(325000 - 102000 - 196816)] [PIA, 12\%, 8] + (145000) (PIF, 12\%, 8)$$

=

$$NPW(12\%)_{M3-0} = -1750000 + (505000 - 104000 - 229619) (PIA, 12\%, 8) + (178000) (PIF, 12\%, 8)$$

reset m3

=

$$NPW(12\%)_{M2-M3} = -(1980000 - 1750000) + [(689000 - 163000 - 259797) - (505000 - 104000 - 229619)] (PIA, 12\%, 8) + (205000 - 178000) (PIF, 12\%, 8) =$$

SCORE: \_\_\_\_\_

Present worth = PW

P given F Present value given future (PIF, interest rate, years)

Find P given F  $P = F(1+i)^{-n}$  ~~Find~~  $n$  is given years

Present worth, Future worth, annual worth  
PW FW a/w = highest number

Equivalent uniform annual cost

EUAC

capital cost

A given P

P given E

P given A

} Pick lowest number

F given P

$$n = \frac{\log(2)}{\log(1+i)}$$

} time to  
double  
money

$$\frac{\log(3)}{\log(1+i)}$$

or 4 to triple or quadruple  
your money

Rank from Lowest to highest initial cost

$$\text{net present worth (MARR)} = -\text{initial cost} + (\text{Annual Benefit} - \text{M\&O})(PIF, \text{MARR}, \text{useful life}) \\ + \text{Salvage value (PIF, MARR, useful life)}$$

if NPW is positive accept challenger drop defender. challenger now becomes new defender.

$$NPW(\text{MARR}) = -\left(\frac{\text{initial cost of challenger}}{\text{initial cost of defender}}\right) + \left[\frac{\text{Annual Benefit of challenger} - \text{M\&O of challenger}}{\text{Annual Benefit of defender} - \text{M\&O of defender}}\right] \\ \left(\frac{\text{PIF, MARR, useful life of challenger}}{\text{PIF, MARR, useful life of defender}}\right) + \left(\frac{\text{Salvage value of challenger} - \text{Salvage value of defender}}{\text{PIF, MARR, useful life of defender}}\right)$$

if  $IRR \geq \text{MARR}$  the investment should be accepted otherwise reject